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THE GENUS *BAPTISIA* (FABACEAE) IN ALABAMA

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ABSTRACT

The primary objectives of this project were to determine which species of *Baptisia* (Fabaceae) occur in Alabama and to report the county distribution of each. *Baptisia*, known commonly as wild or false indigo, is recognized as consisting of seven species in Alabama. The most common species are *Baptisia alba, B. bracteata,* and *B. megacarpa.* The less common species are *B. lanceolata* and *B. albescens*. The least common species are *B. australis* and *B. perfoliata.* The dichotomous key and descriptions we present are modifications from earlier authors; however, all measurements are based on morphological features of the vegetative and reproductive structures of the more than 200 specimens studied during this project. Data for the county-level distribution maps were compiled entirely from herbarium vouchers.

Baptisia, commonly known as wild or false indigo, consists of 18 species, 7 infraspecific taxa, and 6 hybrids confined to the eastern USA and Canada (NatureServe 2013). Of these, 15 species have been reported from the southeastern USA (Isely 1990) and eight species and one infraspecific taxon have been reported from Alabama (Kral et al. 2011).

The genus *Baptisia* Vent. is a member of the legume family Fabaceae (Leguminosae), tribe Thermopsideae, which includes six genera and approximately 45 species scattered through the Mediterranean and eastern North America (Turner 1981). More recently, results based on nuclear ribosomal DNA internal transcribed space (ITS) sequences suggest the Thermopsideae could be reduced to four core genera, *Anagyris*, *Baptisia*, *Pipthanthus*, and *Thermopsis*, which are clustered to form a strong clade (Wang et al 2006).

Two taxa of *Baptisia*, *B. australis* (L.) R. Br. and *B. megacarpa*, have received a state and global rank of G5T2S1, G2S2, respectively (Alabama Natural Heritage Program 2013). *Baptisia perfoliata* (L.) R. Br. ex Ait. f., although it has no state or global rank, is the rarest *Baptisia* in the state, known from only Sumter County, which is the westernmost county in the state. The closest population is Laurens County, Georgia, some 500 km to the east (USDA, NRCS 2013).

The primary objectives of this study were to determine which species of *Baptisia* occur in Alabama and report the county-level distribution of each. Additional goals included providing a dichotomous key, species descriptions, and illustrations for the taxa of *Baptisia* found to occur in Alabama.

Material and methods

Data for the distribution maps were gathered from more than 200 plant specimens deposited in the herbaria of Troy University (TROY), Alabama Natural History Survey (ALNHS), J.D. Freeman (AUA), The University of Alabama (UNA), The University of South Alabama (USAM), The University of West Alabama (UWAL), Jacksonville State University (JSU), Anniston Museum

of Natural History (AMAL), University of North Alabama (UNAF), and Vanderbilt University (VDB), which is housed at the Botanical Research Institute of Texas in Fort Worth.

The dichotomous key is a modification of Isely (1990) and Weakley (2012); however, all measurements are based on morphological features of the vegetative and reproductive structures of the plants examined during this project. Descriptions for each taxon are based on those of Larisey (1940) and Isely (1990), with modifications incorporating measurements taken from the specimens studied. The lists of specimens examined are limited to one record from each county.

Herbarium specimens were initially divided into groups based on overall morphological similarity and the species concept established by Larisey (1940), Isely (1990), and Weakley (2012). Morphological measurements were then made from selected specimens of each group. Field studies were also conducted to observe the species in their natural habitats and make personal collections.

Results

Seven species of *Baptisia* occur in Alabama. The most common species in the state is *Baptisia alba* (L.) Vent., represented in 25 counties. *Baptisia bracteata* Muhl. ex Ell. is represented in 13 counties and *B. megacarpa* Chapm. ex Torr. & Gray is represented in 10 counties. *Baptisia lanceolata* (Walt.) Ell. is represented in six counties and *B. albescens* Small is represented in 5 counties. The least common species are *B. australis* (L.) R. Br. (1 county) and *B. perfoliata* (L.) R. Br. ex Ait. f. (1 county).

TAXONOMIC TREATMENT OF *BAPTISIA* IN ALABAMA

Baptisia Vent., Dec. Gen. Nov. 1808.

Crotalaria Dill. ex L., Gen. Pl., ed. 1, 218. 1737, in part.
Sophora L., Gen. Pl., ed. 1, 125. 1737, in part.
Podalyria Lam., Illust. 2: 454. pl. 327, fig. 3,4. 1793, in part.
Crotalopsis Michx. ex DC., Prodr. 2: 100. 1825, in syn.
Eaplosia Raf., New Fl. 2: 51. 1837 ("1836").
Lasinia Raf., New Fl. 2: 48. 1837 ("1836").
Pericaulon Raf., New Fl. 2: 50. 1837 ("1836").
Ripasia Raf., New Fl. 2: 48. 1837 ("1836").

Perennial herbs. **Stems** ascending or erect, branched, glabrous or pubescent. **Leaves** alternate, palmately trifoliate (upper ones bifoliolate or unifoliolate) or all unifoliolate, sessile or petiolate; leaflets entire, elliptic, elliptic-lanceolate, ovate-elliptic, ovate-lanceolate, oblanceolate to orbicular, stipules absent, caducous or persistent. **Inflorescence** terminal racemes, erect, ascending to arching or flowers 1–2 in leaf axis, bracts small, caducous or subfoliaceous and persistent, bracteoles absent. **Calyces** campanulate 4–8 mm long, lobes 4, subequal, shorter or exceeding tube, pedicels 2–30 mm long; corolla papilionaceous, 13–30 mm long, white, cream, yellow, or violet to blue; androecium monadelphous, stamens 10; style longer than ovary, distally glabrous. **Fruits** stipitate, inflated, lanceolate to globose, coriaceous to woody.

KEY TO THE ALABAMA SPECIES OF *BAPTISIA*

1. Leaves unifoliolate, perfoliate ..... 1. **Baptisia perfoliata**
1. Leaves trifolioate, sessile or petiolate.

    2. Flowers lavender or blue ..... 2. **Baptisia australis**
    2. Flowers white, cream, or yellow.

3. Bracts persistent; pedicels 15–30 mm long; mature racemes arching 3. **Baptisia bracteata**
3. Bracts caducous; pedicels 2–10 mm long; mature racemes ascending or erect.

4. Flowers yellow.

5. Legumes woody, pubescent, 10–25 mm long, 8–12 mm wide; petioles 0.4–12 mm long ..... 4. **Baptisia lanceolata**
5. Legumes thinly-coriaceous, glabrous, 30–40 mm long; petioles 15–20 mm long ..... 5. **Baptisia megacarpa**

4. Flowers white.

6. Calyces 4.5–6.5 mm long; corollas 13–18 mm long; legumes yellow-brown at maturity ..... 6. **Baptisia albescens**
6. Calyces 7–8 mm long; corollas 20–25 mm long; legumes black at maturity ..... 7. **Baptisia alba**

1. **Baptisia perfoliata** (L.) R. Br. in Ait., Hort. Kew., ed. 2, 3: 5. 1811.
Crotalaria perfoliata L., Sp. Pl. 2: 714. 1753.
Sophora perfoliata Walt., Fl. Car. 135. 1788.
Rafnia perfloiata Willd. in L., Sp. Pl. ed. 4, 3: 949. 1800.
Podalyria perfoliata Michx., Fl. Bor. Amer. 1: 263. 1803.
Pericaulon perfoliatum Raf., New, Fl. N. Amer. 2: 51. 1836.
Pericaulon cordatum Raf., New Fl. N. Amer. 2: 51. 1836.

Perennial herbs. **Stems** arching, branched, glabrous, somewhat glaucous. **Leaves** simple, perfoliate, leathery, orbicular to ovate-elliptic, 5–10 cm long, 3–8 cm wide, stipules absent. **Flowers** axillary, solitary. **Calyces** 6–7 mm long, peduncles 4–7 mm long; corolla 13–15 mm long, bright yellow. **Fruits** ovoid to globose, coriaceous, glabrous, brown, 1–1.5 cm long. Figure 1.

Native of Florida, Georgia, and South Carolina. Habitat and distribution in Alabama: dry soil at edge of longleaf pine woods; west-central Alabama.

Specimen examined. Sumter Co.: *Keener 2656*, 17 Jun 2005 (TROY).

2. **Baptisia australis** (L.) R. Br. in Ait., Hort. Kew, ed. 2, 3: 6. 1811.
Sophora australis L., Syst. Veg., ed. 14. 391. 1784.
Sophora caerulea Trew, Pl. Rar. 6, pl. 14. 1779.
Podalyria australis Willd. in L., Sp. Pl., ed. 4, 2: 503. 1799.
Baptisia exalata Sweet, Br. Fl. Gard. 1: pl. 97. 1825.
Baptisia visicolor Lodd., Bot. Cab. 12: pl. 1144. 1826.
Baptisia confusa Sweet ex G. Don, Gen. Syst. [Hort. Brit.], ed. 2, 123. 1830.
Ripasia cerulea Raf., New. Fl. N. Amer. 2: 48. 1837 ("1836").
Baptisia caerulea Michx. in Eaton & Wright, Man. N. Amer. Bot., ed. 8, 154. 1840.
Baptisia australis var. *aberrans* Larisey, Ann. Mo. Bot. Gard., 27: 206. 1940.

Perennial herbs. **Stems** erect, branched, glabrous, somewhat glaucous. **Leaves** trifoliate, petioles 0.2–1.2 cm long; leaflets obovate to obovate-lanceolate, 4–8 cm long, 1.5–3 cm wide, stipules persistent. **Inflorescence** terminal, arching, loosely flowered, 2–5 cm long, bracts caduceus. **Calyces** 9–12 mm long, pedicels 5–10 mm long; corolla 25–30 mm long, lavender or blue. **Fruits** ovoid to globose, coriaceous, glabrous, brown, 1–1.5 cm long. Figure 2.

Native of central and eastern USA. Habitat and distribution in Alabama: river banks and gravel bars; central Alabama.

Specimen examined. Bibb Co.: *Allison 8226*, 30 Apr 1994 (UNA).

3. **Baptisia bracteata** Muhl. ex Ell., Sketch Bot. S. Car. & Ga. 1: 469. 1821.
Podalyria bracteata Muhl., Cat. Pl. Amer. Sept. 42. 1815, nomen subnudum.
Lasinia bracteata Raf., New. Fl. N. Amer. 2: 50. 1837 ("1836").
Baptisia leucophaea Nutt. ex Chapm., Fl. South. U.S., ed. 1, 112. 1860.
Baptisia saligna Greene, Leafl. Bot. Obs. 2: 84. 1910.

Perennial herbs. **Stems** erect, branched, glabrous to pubescent. **Leaves** trifoliate, petioles 0.3–1.2 cm long; leaflets oblanceolate to obovate or elliptic-obovate, 5–10 cm long, 2–3.5 cm wide; stipules persistent with those of medial leaves foliaceous. **Inflorescence** axillary, arching, secund, 10–20 cm long, bracts persistent. **Calyces** 7–10 mm long, pedicels 15–30 mm long; corolla 18–25 mm long, cream or yellow. **Fruits** elliptic, woody, subappressed-pubescence, brown, 3–5 cm long. Figure 3.

Native of southeastern USA. Habitat and distribution in Alabama: dry pine and oak woods, roadsides; central and northeastern Alabama.

Specimens examined. Calhoun Co.: *Hansen 2099*, 18 Apr 2006 (TROY). Cherokee Co.: *Barger 25*, 25 Apr 2007 (TROY). Chilton Co.: *Diamond, 15467*, 16 Jun 2005 (TROY). Clay Co.: *Haynes, 9054*, 30 Apr 1977 (UNA). Cleburne Co.: *Keener 3467*, 8 Apr 2007 (UWAL). Coosa Co.: *Keener 4348*, 28 Apr 2008 (UWAL). DeKalb Co.: *Searcy s.n.*, 30 Apr 1966 (AUA). Etowah Co.: *Spaulding & Soehren 10502*, 1 May 1998 (JSU). Jefferson Co.: *Wright s.n.*, 15 Apr 1965 (AUA). Lee Co.: *Davis s.n.*, 27 Apr 1957 (AUA). Shelby Co.: *Whetstone & Ballard 16293*, 4 Apr 1993 (JSU). St. Clair Co.: *Bradshaw 81*, 9 Apr 1977 (UNA). Talladega Co.: *Hilton 159*, 15 Apr 1994 (AUA).

4. **Baptisia lanceolata** (Walt.) Ell., Sketch Bot. S. Carolina 1: 467. 1817.
Sophora lanceolata Walt., Fl. Car. 135. 1788.
Podalyria uniflora Michx., Fl. Bor. Amer. 1: 263. 1803.
Baptisia uniflora (Michx.) Nutt., Gen. N. Amer. Pl. 1: 281. 1818.
Lasinia reticulata Raf., New Fl. N. Amer. 2: 48. 1836 [1837].
Baptisia elliptica Small, Fl. S.E. U.S., 559, 1331. 1903.
Baptisia elliptica var. *tomentosa* Larisey, Ann. Mo. Bot. Gard. 27(2): 150. 1940.
Baptisia lanceolata var. *tomentosa* (Larisey) Isely, Brittonia 30: 471. 1978.
Baptisia lanceolata var. *elliptica* (Small) B.L. Turner, Phytologia 88: 256. 2006.

Perennial herbs. **Stems** erect, branched, glabrous or appressed pubescence. **Leaves** trifoliate, petioles 0.4–1.2 cm long; leaflets obovate, elliptic, lanceolate or oblanceolate, 5–13 cm long, 2–3.5 cm wide, stipules caducous. **Inflorescence** axillary or terminal, erect, 3–6 cm long; bracts persistent. **Calyces** 8–10 mm long, pedicels 2–10 mm long; corolla 20–25 mm long, yellow. **Fruits** suborbicular to lanceolate, woody, glabrous or with remnants of pubescence, black, 1–2.5 cm long. Figure 4.

Native of southeast USA. Habitat and distribution in Alabama: dry pine and oak woods, roadsides; extreme southern Alabama.

Specimens examined. Baldwin Co.: *Kenner 2899*, 5 May 2006 (TROY). Covington Co.: *Diamond 20560*, 9 Apr 2009 (TROY). Escambia Co.: *Diamond 13204*, 19 May 2002 (TROY).

Geneva Co.: *Kral, 34538*, 26 Apr 1969 (AUA). Houston Co.: *MacDonald 8627*, 7 May 1995 (UNA). Mobile Co.: *Mohr s.n.*, Jun 1879 (UNA).

5. **Baptisia megacarpa** Chapm. ex Torr. & Gray, Fl. N. Amer. 1: 386. 1840.
Baptisia riparia Larisey, Ann. Missouri Bot. Gard. 27: 192, t. 26(1). 1940.
Baptisia riparia var. *minima* Larisey, Ann. Missouri Bot. Gard. 27: 193, t. 26(2). 1940.

Perennial herbs. **Stems** erect, branched, glabrous. **Leaves** trifoliate, petioles 1.5–2 cm long; leaflets broadly elliptic, 4–8 cm long, 1.5–4 cm wide, stipules caducous. **Inflorescence** terminal and axillary, erect, 7–15 cm long, bracts caducous. **Calyces** 8–10 mm long, pedicels 12–15 mm long; corolla 17–22 mm long, yellow. **Fruits** ellipsoid to ovoid, bladdery-inflated, thinly-coriaceous, glabrous, tan to brown, 3.5–5 cm long. Figure 5.

Native of southeastern USA. Habitat and distribution in Alabama: dry pine and oak woods, moist ravines, stream edges and roadsides; south central and southeastern Alabama.

Specimens examined. Bibb Co.: *Kenner 4505*, 27 May 2008 (UWAL). Bullock Co.: *Diamond 24009*, 9 May 2013 (TROY). Crenshaw Co.: *Diamond 11866*, 16 Jul 2000 (TROY). Coosa Co.: *Diamond 24441* 11 Aug 2013 (TROY). Escambia Co.: *Brittain 270,* 21 May 1995 (TROY). Lee Co.: *Sessler 174,* 21 May 1975 (AUA). Macon Co.: *Redmond 125*, 24 May 1970 (AUA). Montgomery Co.: *Harper 4114*, 7 May 1949 (UNA). Pike Co.: *Diamond 21975,* 26 Apr 2011 (TROY). Tallaposa Co.: *Schotz 2014,* 10 May 2006 (AUA).

6. **Baptisia albescens** Small, Fl. S.E U.S., ed. 1, 600, 1331. 1903. 1800.

Perennial herbs. **Stems** erect, branched, sparsely pubescent when young, becoming glabrous. **Leaves** trifoliate, petioles 0.5–1.8 cm long; leaflets elliptic-lanceolate to obovate, 2–6 cm long, 0.5–1.5 cm wide, stipules caducous. **Inflorescence** terminal, erect, 15–40 cm long, bracts caducous. **Calyces** 5–8 mm long, pedicels 6–10 mm long; corolla 13–17 mm long, white. **Fruits** cylindrical to oblong-lanceolate, coriaceous, glabrous, yellow-brown, 2–3.5 cm long. Figure 6.

Native of southeast USA. Habitat and distribution in Alabama: dry pine woods, sandy areas and roadsides; southeastern Alabama.

Specimens examined. Barbour Co.: *Diamond 21985*, 26 Apr 2011 (TROY). Bullock Co.: *Barger 278*, 5 May 2011 (ALNHS). Houston Co.: *Mohr 1165*, 27 May 1971 (TROY). Lee Co.: *Kral 62292A,* 11 Jul 1978 (AUA). Russell Co.: *Diamond 9122*, 1 May 1994 (AUA).

7. **Baptisia alba** (L.) Vent., Dec. Gen. Nov. 1808.
Crotalaria alba L., Sp. Pl. 2: 716. 1753.
Sophora alba L., Syst. Nat., ed. 12, 2: 287. 1767.
Podalyria alba Willd. in L., Sp. Pl., ed. 4, 2: 503. 1799.
Baptisia albiflora Raf., New Fl. N. Amer. 2: 47. 1836 [1837].
Baptisia alba var. *macrophylla* (Larisey) Isely, Sida 11: 435. 1986.

Perennial herbs. **Stems** erect, branched, glabrous, glaucous. **Leaves** trifoliate, petioles 1–2 cm long; leaflets elliptic-obovate to oblanceolate, 2–6 cm long, 0.8–2.5 cm wide, stipules caducous. **Inflorescence** terminal, erect, 25–50 cm long, bracts caducous. **Calyces** 7–8 mm long, pedicels 3–10 mm long; corolla 20–25 mm long, white. **Fruits** cylindrical to ellipsoid to ellipsoid-cylindric, coriaceous, glabrous, black, 2–5 cm long. Figure 7.

Native of central and southeastern USA. Habitat and distribution in Alabama: dry pine and woods, open fields, floodplains and roadsides; throughout Alabama.

Specimens examined. Bibb Co.: *Moore s.n.*, 9 Apr 1955 (AUA). Butler Co.: *Diamond 17393*, 18 Apr 2007 (TROY). Cherokee Co.: *Whetstone 10000*, 6 May 1980 (JSU). Choctaw Co.: *Tippins s.n.*, 28 Apr 1952 (AUA). Clark Co.: *Henderson 23*, 4 May 1981 (AUA). Colbert Co.: *Whetstone 4349*, 6 Jun 1975 (JSU). Conecuh Co.: *Diamond 8693*, 26 Jun 1993 (AUA). Covington Co.: *Jones 539*, 7 Apr 1960 (AUA). Dale Co.: *Diamond 8223*, 3 May 1992 (AUA). Fayette Co.: *Haynes 9942*, 30 Apr 1999 (UNA). Green Co.: *Keener 2649*, 28 Apr 2005 (TROY). Henry Co.: *Diamond 18965*, 13 Apr 2008 (TROY). Jackson Co.: *Brodeur 1822*, 18 May 1999 (JSU). Macon Co.: *Lancaster 164*, 8 Apr 1974 (AUA). Madison Co.: *Curley s.n.*, 19 May 1973 (JSU). Morengo Co.: *England 1952*, 17 Apr 2009 (UWAL). Mobile Co.: *Mohr s.n.*, Jun 1867 (UNA). Montgomery Co.: *Hutto 206*, 12 Apr 1974 (AUA). Morgan Co.: *Keener 2601*, 18 Apr 2003 (TROY). Pickens Co.: *Kral 46783*, 28 May 1972 (JSU). Pike Co.: *Diamond 12408*, 29 Apr 2001 (TROY). Russell Co.: *Gil 2001-135*, 25 Apr 2002 (AUA). Sumter Co.: *Harris s.n.*, 25 May 2003 (UWAL). Tuscaloosa Co.: *Spaulding 11020*, 21 Apr 2001 (UNA). Washington Co.: *Zebryk 8575*, 29 May 2004 (USAM).

DISCUSSION

In Alabama, *Baptisia* is a conspicuous taxon of open pine or oak woodlands, sandhills, slopes, cedar glades, barrens, pastures, and roadsides (Isely 1990). The state and global ranked taxon *B. australis* has a more restricted habitat, occurring only on river banks and gravel bars. The entire plant in all species of *Baptisia* contains toxic properties, which include various alkaloids and glycosides (Gibbons et al. 1990).

A combination of morphological characteristics can be used to differentiate the seven species of *Baptisia* in Alabama. *Baptisia perfoliata* and *B. australis* are the most easily recognized taxa. *Baptisia perfoliata* has simple, perfoliate leaves, whereas, the remaining taxa have trifolioate leaves. *Baptisia australis* has lavender or blue flowers and the remaining taxa have white or cream colored to yellow flowers. *Baptisia bracteata* is unique in having large and persistent stipules, 15–40 mm long, bracts 5–30 mm long and pedicels 15–30 mm long. The remaining four taxa have stipules less than 5 mm long or caducous, persistent bracts, 2–5 mm long and pedicels 2–10 mm long. The foliage of *B. megacarpa* and *B. alba* are similar, but *B. megacarpa* differs in having yellow flowers and fruits that dry tan, whereas, *B. alba* has white flowers and fruits that dry black. The only other species of *Baptisia* in Alabama to have white flowers is *B. albescens*. It differs by having shorter calyces (4.5–6.5 mm long) and smaller flowers (13–18 mm long) compared to 7–8 mm and 20–25 mm long, respectively, for *B. alba*. The dried fruits of *B. albescens* are yellow-brown. *Baptisia lanceolata* is unique in having a short terminal raceme (2–6 flowers) and 1–2 flowers in the leaf axis.

The only two *Baptisia* taxa with a state and global rank, *B. australis* (G5T2S1) and *B. megacarpa* (G2S2), appear to be in no imminent danger of extirpation. *Baptisia megacarpa* occurs in nine counties in the southern half of the state and is found in several different habitats (dry woods, mixed hardwoods, densely shaded hardwoods, pine woods, clear cuts, stream edges, and roadsides). *Baptisia australis* occurs only on gravel bars and rocky-river banks of the Little Cahaba River in Bibb County but appears to be well protected. In 1996, The Nature Conservancy purchased land to create the Bibb County Glades Preserve, which protects the section of the river where this taxon is known to occur. Additionally, in 2003, the U.S. Fish and Wildlife Service purchased land adjacent to Bibb County Glades Preserve and created the Cahaba River National Wildlife Refuge. The Nature Conservancy and the U.S. Fish and Wildlife Service both are continuing efforts to expand the refuge, and *B. australis*, along with several other rare taxa, should be protected for future generations.

Baptisia perfoliata, although it has no state or global rank, is the rarest *Baptisia* in the state. It is known from only Sumter County in Alabama, which is the westernmost county in the state. The closest population is Laurens County, Georgia, some 500 km to the east. In 2013, this population consisted of approximately 30 plants. The taxon occurs on land owned by American Legion and is

not considered native to Alabama. It is thought to have been introduced in the 1950's when Auburn University planted longleaf pine brought from Georgia.

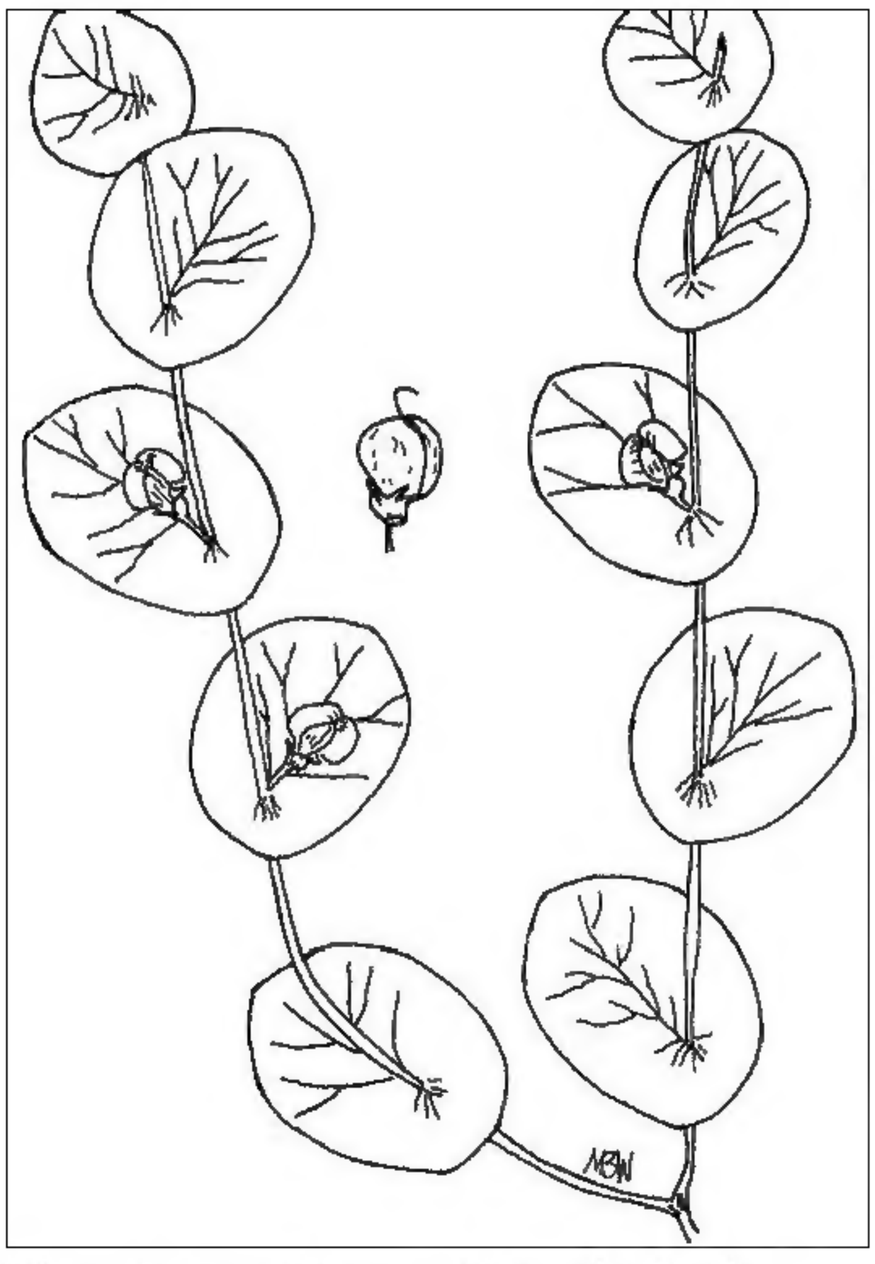


Figure 1. *Baptisia perfoliata*, distribution.

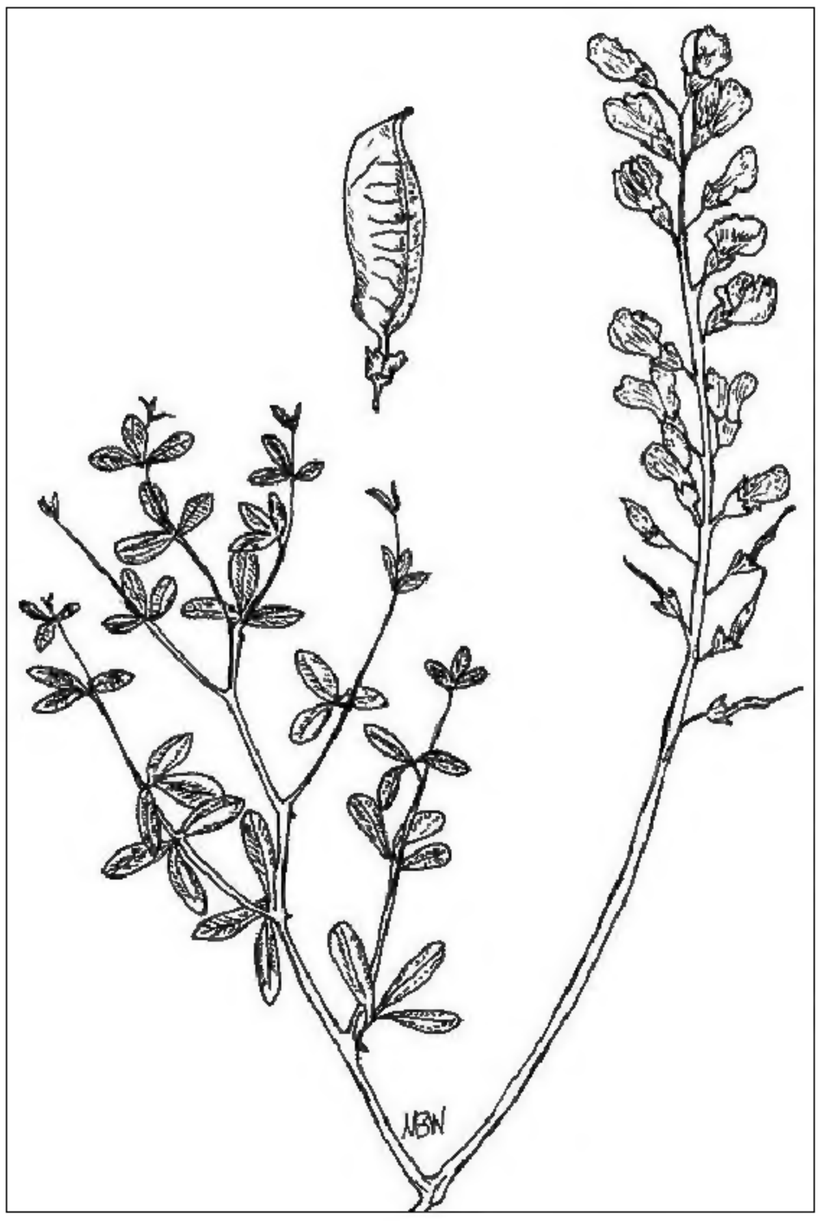
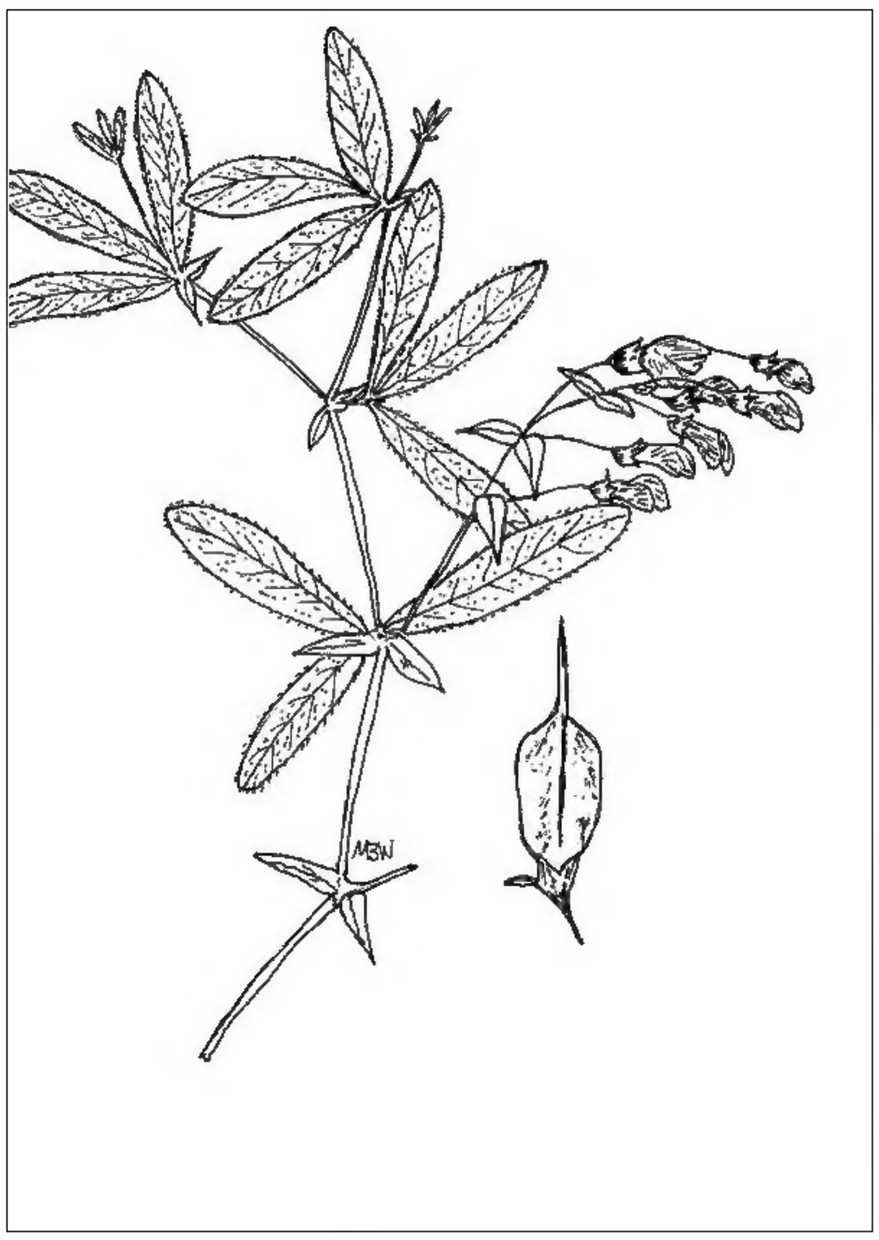


Figure 2. *Baptisia australis*, distribution.



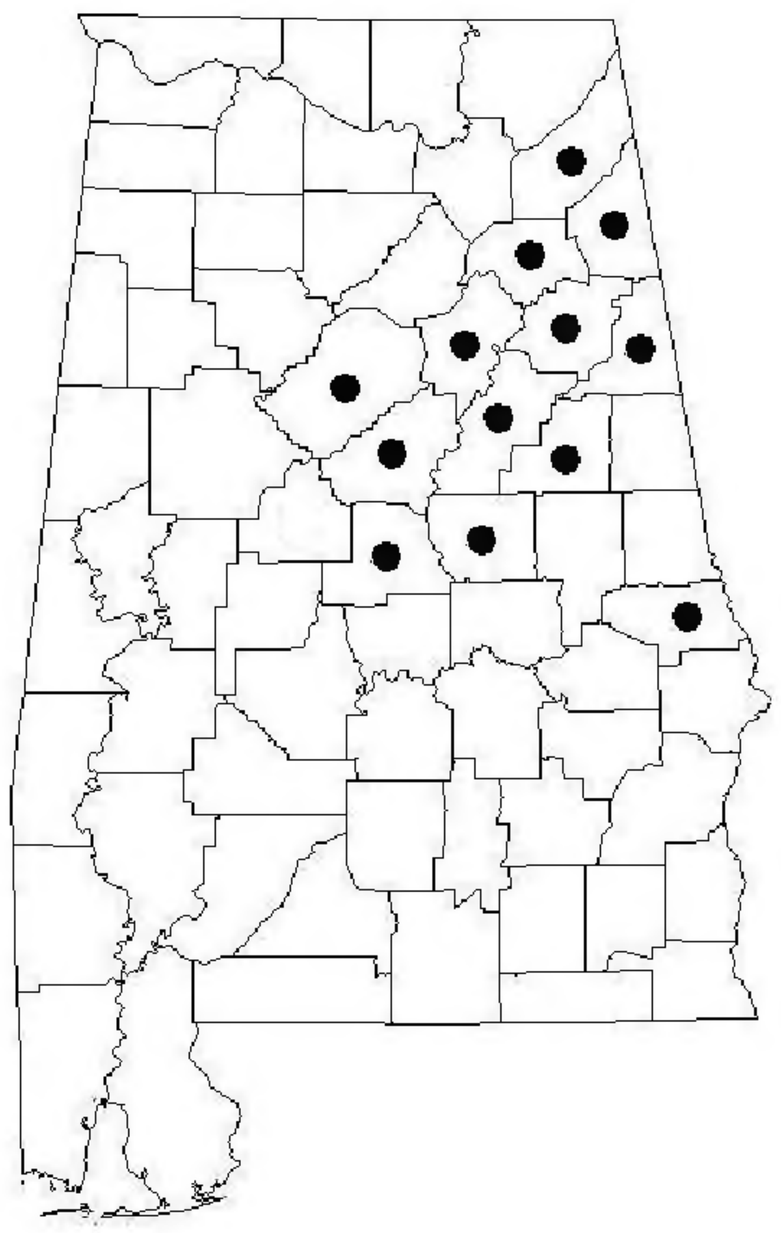
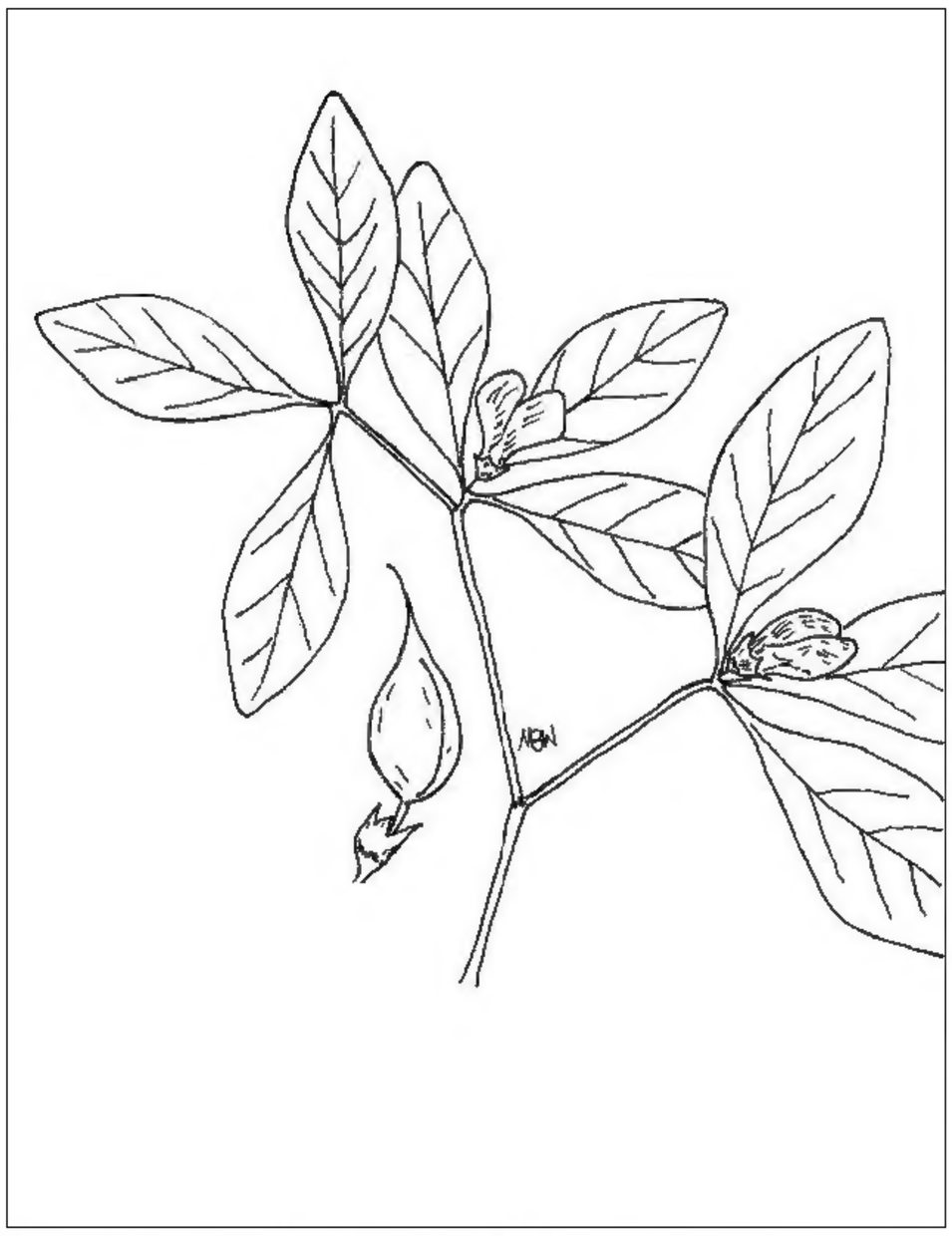


Figure 3. *Baptisia bracteata*, distribution.



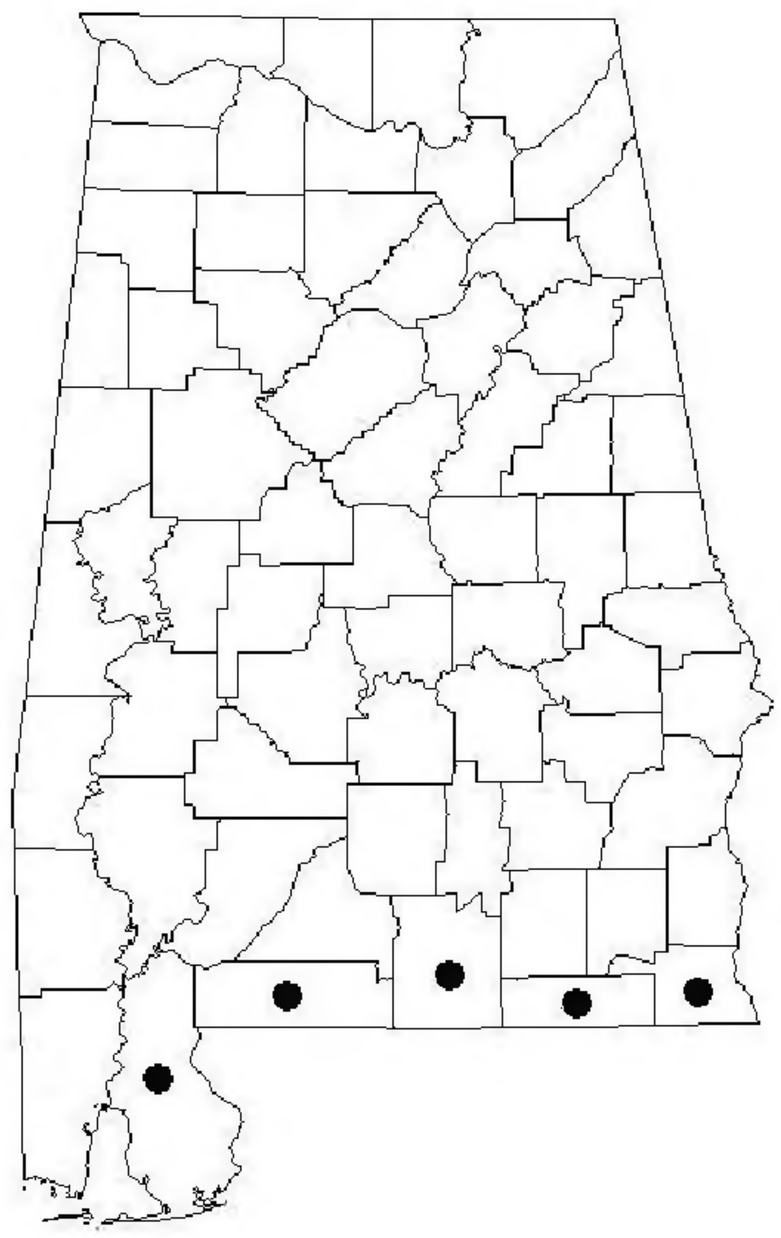
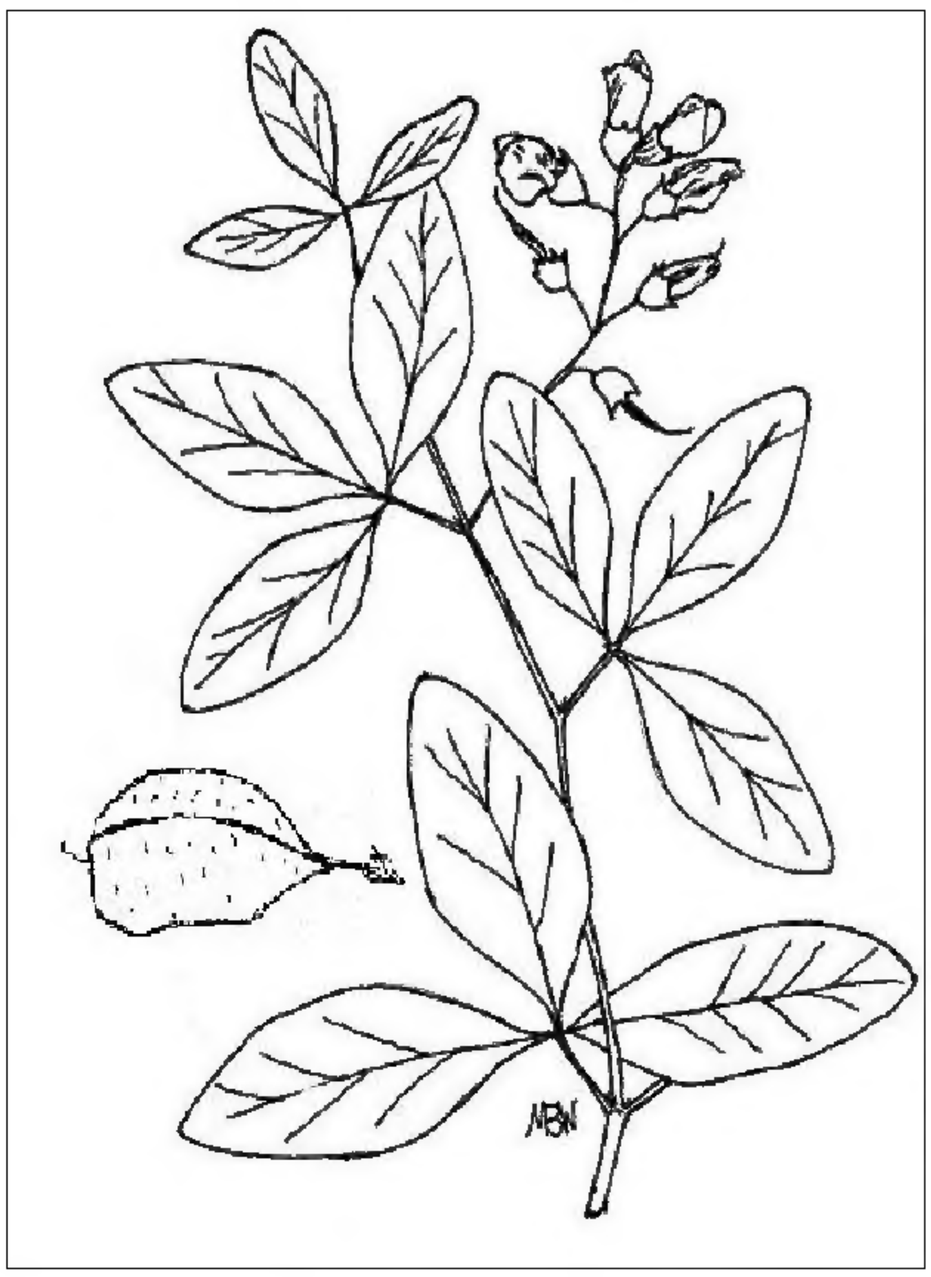


Figure 4. *Baptisia lanceolata*, distribution.



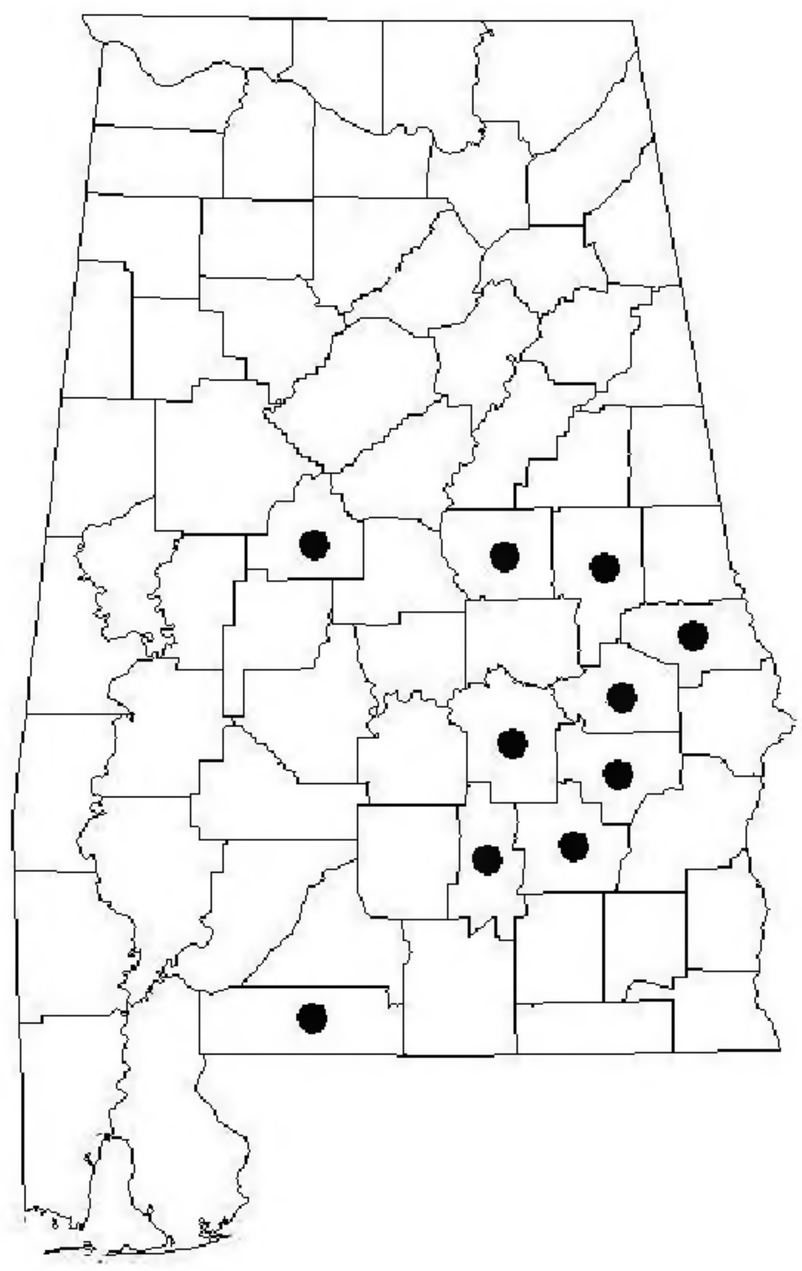


Figure 5. *Baptisia megacarpa*, distribution.

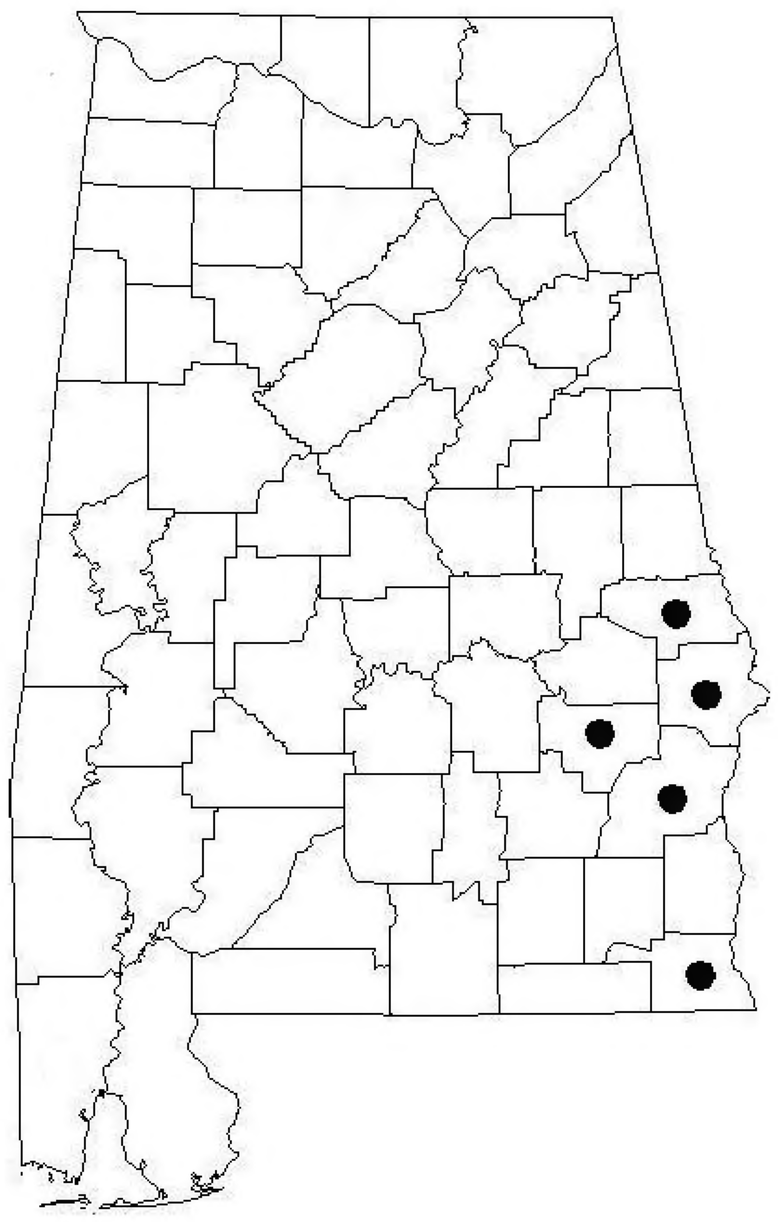


Figure 6. *Baptisia albescens*, distribution.

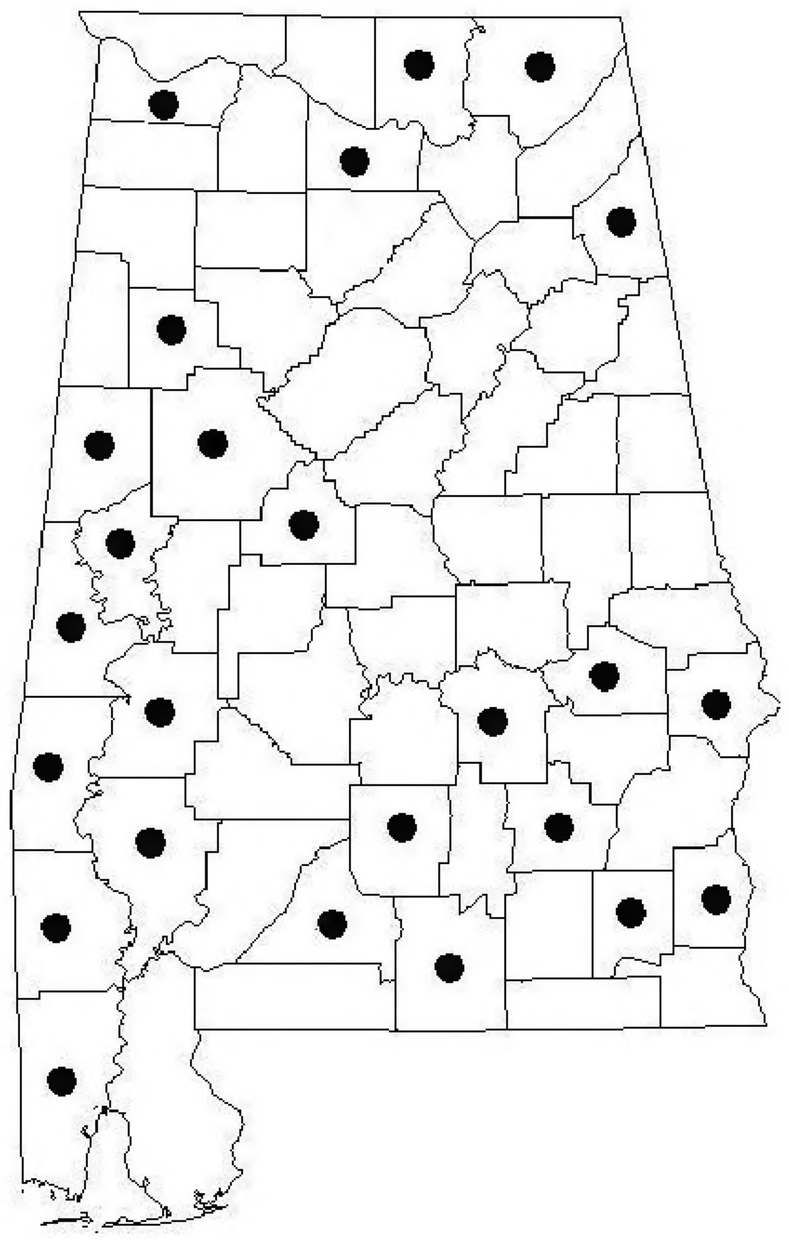


Figure 7. *Baptisia alba*, distribution.

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